

WHAT IS CLAIMED IS:

1. A medical instrument holding apparatus comprising:

5 a supporting mechanism which supports a medical instrument;

a moving mechanism which has first and second sides, and a shaft portion located between the first and second sides and which supports the supporting mechanism, allowing the medical instrument and the 10 supporting mechanism to be moved around the shaft portion;

15 a basal portion which is coupled to the shaft portion and which supports the moving mechanism, allowing the moving mechanism to rotate around the shaft portion; and

a counterweight which is located on the second side of the moving mechanism and generates a first rotation moment being smaller than a second rotation moment generated from the weights of the medical 20 instrument and the supporting mechanism and acting around the shaft portion in the opposite direction to the second rotation moment.

25 2. A medical instrument holding apparatus according to claim 1, wherein the moving mechanism and the supporting mechanism have braking mechanisms capable of being switched between a restrictive state in which the moving and supporting mechanisms are

prevented from moving and a permissive state in which
the mechanisms are allowed to move, and the supporting
mechanism has a switch which is operated by an operator
and switches the braking mechanisms to switch the
5 moving and supporting mechanisms between the
restrictive state and the permissive state.

3. A medical instrument holding apparatus
according to claim 2, wherein the supporting mechanism
includes: a holding portion which supports the medical
10 instrument and is held by the operator, the holding
portion being located so that the center of gravity of
the combination of the holding portion and the medical
instrument and the center of operation by the operator
are situated in different positions on the holding
15 portion; a support arm having one end and the other
end, the one end being supported on the moving
mechanism; and a joint which is supported on the other
end of the support arm and supports the holding portion
so as to be inclinable with respect to the support arm,
20 the center of inclination of the joint around which the
holding portion is inclined by means of the joint being
situated in a position different from the center of
gravity of the center of gravity of the combination of
the holding portion and the medical instrument.

25 4. A medical instrument holding apparatus
according to claim 3, wherein the moving mechanism has
a parallelogrammatic link mechanism, the link mechanism

including: a first arm having one end connected to the support arm; a second arm having one end rotatably connected to the one end of the first arm, the second arm being provided with the shaft portion which is
5 located between the one and the other ends of the second arm and supports the whole moving mechanism for rotating motion; a third arm kept parallel to the second arm and having one end connected to the other end of the first arm; and a fourth arm having one end connected to the other end of the second arm and connected to the third arm so as to be parallel to the first arm, the counterweight being located on the other end of the fourth arm.
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5. A medical instrument holding apparatus according to claim 4, wherein the first arm is shorter than the fourth and second arms.

15 6. A medical instrument holding apparatus according to claim 5, wherein the counterweight has an adjusting mechanism which adjusts the position of the center of gravity of the counterweight along the axis 20 of the fourth arm.

25 7. A medical instrument holding apparatus according to claim 6, wherein the joint includes a detecting mechanism which detects the angle of inclination of the holding portion to the moving mechanism, and the adjusting mechanism includes an arithmetic mechanism which calculates the variation of

the rotation moment around the shaft portion, based on
the angle of inclination of the holding portion
detected by means of the detecting mechanism, and a
barycenter position adjusting mechanism which moves the
5 counterweight along the axis of the fourth arm, thereby
adjusting the position of the center of gravity of the
counterweight, in accordance with the result of
computation by the arithmetic mechanism.

8. A medical instrument holding apparatus
10 according to claim 4, wherein the counterweight has an
adjusting mechanism which adjusts the position of the
center of gravity of the counterweight along the axis
of the fourth arm.

9. A medical instrument holding apparatus
15 according to claim 8, wherein the joint includes a
detecting mechanism which detects the angle of
inclination of the holding portion to the moving
mechanism, and the adjusting mechanism includes an
arithmetic mechanism which calculates the variation of
20 the rotation moment around the shaft portion, based on
the angle of inclination of the holding portion
detected by means of the detecting mechanism, and a
barycenter position adjusting mechanism which moves the
counterweight along the axis of the fourth arm, thereby
25 adjusting the position of the center of gravity of the
counterweight, in accordance with the result of
computation by the arithmetic mechanism.

10. A medical instrument holding apparatus according to claim 2, wherein the moving mechanism has a parallelogrammatic link mechanism, the link mechanism including: a first arm supported on the supporting mechanism; a second arm having one end rotatably connected to one end of the first arm, the second arm being provided with the shaft portion which is located between the one and the other ends of the second arm and supports the whole moving mechanism for rotating motion; a third arm kept parallel to the second arm and having one end connected to the other end of the first arm; and a fourth arm having one end connected to the other end of the second arm and connected to the third arm so as to be parallel to the first arm, the fourth arm having the counterweight on the other end thereof.

11. A medical instrument holding apparatus according to claim 10, wherein the first arm is shorter than the fourth and second arms.

12. A medical instrument holding apparatus according to claim 11, wherein the counterweight has an adjusting mechanism which adjusts the position of the center of gravity of the counterweight along the axis of the fourth arm.

13. A medical instrument holding apparatus according to claim 12, wherein the joint includes a detecting mechanism which detects the angle of inclination of the holding portion to the moving

mechanism, and the adjusting mechanism includes an arithmetic mechanism which calculates the variation of the rotation moment around the shaft portion, based on the angle of inclination of the holding portion
5 detected by means of the detecting mechanism, and a barycenter position adjusting mechanism which moves the counterweight along the axis of the fourth arm, thereby adjusting the position of the center of gravity of the counterweight, in accordance with the result of
10 computation by the arithmetic mechanism.

14. A medical instrument holding apparatus according to claim 10, wherein the counterweight has an adjusting mechanism which adjusts the position of the center of gravity of the counterweight along the axis
15 of the fourth arm.

15. A medical instrument holding apparatus according to claim 14, wherein the joint includes a detecting mechanism which detects the angle of inclination of the holding portion to the moving mechanism, and the adjusting mechanism includes an arithmetic mechanism which calculates the variation of the rotation moment around the shaft portion, based on the angle of inclination of the holding portion
20 detected by means of the detecting mechanism, and a barycenter position adjusting mechanism which moves the counterweight along the axis of the fourth arm, thereby adjusting the position of the center of gravity of the
25

counterweight, in accordance with the result of computation by the arithmetic mechanism.

16. A medical instrument holding apparatus according to claim 1, wherein the supporting mechanism includes: a holding portion which supports the medical instrument and is held by the operator, the holding portion being located so that the center of gravity of the combination of the holding portion and the medical instrument and the center of operation by the operator are situated in different positions; a joint which supports the holding portion so as to be inclinable, the center of inclination of the joint around which the holding portion is inclined by means of the joint being situated in a position different from the center of gravity of a heavy structure including the holding portion and the medical instrument; and a support arm having one end and the other end, the one end being supported on the moving mechanism and the other end supporting the joint.

17. A medical instrument holding apparatus according to claim 16, wherein the moving mechanism has a parallelogrammatic link mechanism, the link mechanism including: a first arm having one end connected to the support arm; a second arm having one end rotatably connected to the one end of the first arm, the second arm being provided with the shaft portion which is located between the one and the other ends of the

second arm and supports the whole moving mechanism for rotating motion; a third arm kept parallel to the second arm and having one end connected to the other end of the first arm; and a fourth arm having one end 5 connected to the other end of the second arm and connected to the third arm so as to be parallel to the first arm, the counterweight being located on the other end of the fourth arm.

18. A medical instrument holding apparatus
10 according to claim 17, wherein the first arm is shorter than the fourth and second arms.

19. A medical instrument holding apparatus
according to claim 18, wherein the counterweight has an
adjusting mechanism which adjusts the position of the
15 center of gravity of the counterweight along the axis
of the fourth arm.

20. A medical instrument holding apparatus
according to claim 19, wherein the joint includes a
detecting mechanism which detects the angle of
incline of the holding portion to the moving
20 mechanism, and the adjusting mechanism includes an
arithmetic mechanism which calculates the variation of
the rotation moment around the shaft portion, based on
the angle of inclination of the holding portion
detected by means of the detecting mechanism, and a
25 barycenter position adjusting mechanism which moves the
counterweight along the axis of the fourth arm, thereby

adjusting the position of the center of gravity of the counterweight, in accordance with the result of computation by the arithmetic mechanism.

21. A medical instrument holding apparatus
5 according to claim 17, wherein the counterweight has an adjusting mechanism which adjusts the position of the center of gravity of the counterweight along the axis of the fourth arm.

22. A medical instrument holding apparatus
10 according to claim 21, wherein the joint includes a detecting mechanism which detects the angle of inclination of the holding portion to the moving mechanism, and the adjusting mechanism includes an arithmetic mechanism which calculates the variation of
15 the rotation moment around the shaft portion, based on the angle of inclination of the holding portion detected by means of the detecting mechanism, and a barycenter position adjusting mechanism which moves the counterweight along the axis of the fourth arm, thereby
20 adjusting the position of the center of gravity of the counterweight, in accordance with the result of computation by the arithmetic mechanism.

23. A medical instrument holding apparatus
according to claim 1, wherein the moving mechanism has
25 a parallelogrammatic link mechanism, the link mechanism including: a first arm supported on the supporting mechanism; a second arm having one end rotatably

connected to one end of the first arm, the second arm being provided with the shaft portion, which is located between the one and the other ends of the second arm and supports the whole moving mechanism for rotating motion, and coupled to the basal portion by means of the shaft portion; a third arm kept parallel to the second arm and having one end connected to the other end of the first arm; and a fourth arm having one end connected to the other end of the second arm and connected to the third arm so as to be parallel to the first arm, the fourth arm having the counterweight on the other end thereof.

24. A medical instrument holding apparatus according to claim 23, wherein the first arm is shorter than the fourth and second arms.

25. A medical instrument holding apparatus according to claim 24, wherein the counterweight has an adjusting mechanism which adjusts the position of the center of gravity of the counterweight along the axis of the fourth arm.

26. A medical instrument holding apparatus according to claim 25, wherein the joint includes a detecting mechanism which detects the angle of inclination of the holding portion to the moving mechanism, and the adjusting mechanism includes an arithmetic mechanism which calculates the variation of the rotation moment around the shaft portion, based on

the angle of inclination of the holding portion
detected by means of the detecting mechanism, and a
barycenter position adjusting mechanism which moves the
counterweight along the axis of the fourth arm, thereby
5 adjusting the position of the center of gravity of the
counterweight, in accordance with the result of
computation by the arithmetic mechanism.

27. A medical instrument holding apparatus
comprising:

10 a basal portion having one end fixed and a shaft
portion on the other end portion thereof;

a rotating member having one end portion and the
other end portion, the shaft portion being located by
the one and the other end portions;

15 a supporting mechanism which is located on the one
end portion of the rotating member and supports a
medical instrument; and

20 a counterweight which is located on the other end
portion of the rotating member and generates a rotation
moment lower than and opposite to a rotation moment
around the shaft portion caused by the sum of the
respective weights of the medical instrument and the
supporting mechanism.

25 28. A medical instrument holding apparatus
according to claim 27, wherein the supporting mechanism
includes: a holding portion which supports the medical
instrument and is held by the operator, the holding

portion being located so that the center of gravity of
the combination of the holding portion and the medical
instrument and the center of operation by the operator
are situated in different positions; a joint which
5 supports the holding portion so as to be inclinable,
the center of inclination of the joint around which the
holding portion is inclined by means of the joint being
situated in a position different from the center of
gravity of the combination of the holding portion and
10 the medical instrument; and a support arm having one
end and the other end, the one end being supported on
the moving mechanism and the other end supporting the
joint.

29. A medical instrument holding apparatus
15 according to claim 28, wherein the rotating member has
a parallelogrammatic link mechanism, the link mechanism
including: a first arm having one end connected to the
one end of the support arm; a second arm having one end
rotatably connected to the one end of the first arm,
20 the second arm being provided with the shaft portion
which is located between the one and the other ends of
the second arm and supports the whole rotating member
for rotating motion; a third arm kept parallel to the
second arm and having one end connected to the other
25 end of the first arm; and a fourth arm having one end
connected to the other end of the second arm and
connected to the third arm so as to be parallel to the

first arm, the fourth arm having the counterweight located on the other end of therefore.

30. A medical instrument holding apparatus comprising:

5 supporting means which supports a medical instrument;

moving means which supports the supporting means, allowing the supporting means to move at one side thereof, the moving means having a shaft portion and 10 rotating the supporting means around the shaft portion, thereby moving the medical instrument;

a basal portion which is coupled to the shaft portion and supports the moving means, allowing the moving means to rotate around the shaft portion;

15 a counterweight which is located on the other side of the moving means and generates a rotation moment smaller than and opposite to a rotation moment around the shaft portion caused by the respective weights of the medical instrument and the supporting means.

20 31. A medicalinstrument holding apparatus according to claim 30, wherein the supporting means includes: holding means which supports the medical instrument and is held by the operator, the holding means being located so that the center of gravity of 25 the combination of the holding means and the medical instrument and the center of operation by the operator are situated in different positions on the holding

means; a tilting mechanism which supports the holding means so as to be inclinable, the center of inclination of the tilting mechanism around which the holding means is inclined by means of the tilting mechanism being
5 situated in a position different from the center of gravity of the combination of the holding means and the medical instrument; and a support arm having one end and the other end, the one end being supported on the moving means and the other end supporting the tilting
10 mechanism.